A Century of Mathematics in America. 3 vols. Peter A. Duren, Ed. Providence, Rhode Island (American Mathematical Society). 1988.

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The American Mathematical Society (AMS) was founded in 1888 as the New York Mathematical Society. On its semicentennial, and again on its centennial, the AMS sponsored retrospective exercises. These volumes present results of the 1988 effort. Their preface explains that a "Committee on the History of Mathematics was appointed to organize and oversee the collection of suitable materials, and to continue a program of publication of mathematical history beyond the Centennial year." Further details on this continuing program are not supplied; presumably they may be obtained from Professor Duren, who is Chair of the Committee as well as principal editor of these volumes.

To quote the preface further:

> In August 1987, the Committee . . . sent a letter to a group of distinguished senior American mathematicians, consisting of past Presidents of the AMS and others thought to have an interest in some aspect of mathematical history. Each was invited to contribute "an autobiographically oriented historical article" discussing some aspect of American mathematical history over the past century.
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> The response exceeded all expectations. The outpouring of enthusiasm was almost overwhelming. A large variety of topics emerged, additional writers were suggested, and materials appropriate for reprinting were identified. The result is a two-volume collection of historical articles, both newly written and reprinted, glimpses of America's mathematical past. This volume begins with two reprinted accounts of the early days of the Society by Thomas Fiske. Other subjects are mathematicians, institutions, organizations, books, computers, political events, refugees, war work, social currents, meetings, working conditions, and of course mathematics itself."

Part III, evidently not anticipated when the above was written, explains in its preface that the enthusiastic response and the multitude of good ideas coming from "the mathematical community" required a third volume to handle them.

I doubt that I am alone in the apprehensions that the Committee's invitation evokes. Rambling, disjointed sequences of anecdotes of uneven reliability, and wishful re-creations of the past, seemed to be a large part of what they were letting themselves in for. These are present, in some of the reprinted work as well, but the diversity of the collection is such that it has something for every set of standards of scholarship.

About one-third of the hundred or so articles are reprints. Given that these could be selected on the basis of complete information, it is not surprising that they contain some of the best writing in the collection. Among reprinted materials are obituaries (of A. Albert, L. Eisenhart, O. Veblen, M. Bôcher, W. Osgood, C. A. Scott, E. B. VanVleck, R. L. Moore, A. J. P. Wheeler, N. Wiener, and J. B. Robinson). The first of the pieces by Fiske treats the status of mathematics in the United States in 1905; the second reminisces in 1938 over much the same ground.

Reprinted pieces by Mina Rees and J. Barkley Rosser, as well as a new article by Saunders MacLane in the third volume, treat the activities of mathematicians during World War II. Since then, and especially in the immediate postwar period, the contributions made to war-related activities by "pure" mathematicians have been a persuasive element in arguments to Congress for support. One can easily imagine a recitation of the Navy's citations of Hassler Whitney, as quoted in MacLane's article on the group working at Columbia, as the capstone of such an argument.

The excellent 1981 *Annals of Science* piece by Reingold on refugee mathematicians of the thirties and forties and new essays by Niven and Bers treating the same period (all in the first volume), were particularly effective with this reader in stimulating comparisons with our own time. As we confront the availability of many able Soviet mathematicians, among them some of the world's very best, and the nearly stateless status of some outstanding young Chinese scholars, comparisons with those times are inevitable and instructive.

One may argue that for many of the earlier refugees the choice was emigration or death, and that the Great Depression made placement incomparably more difficult than today. On the former count, the world and the refugees themselves did not—could not—imagine the horror in store for those left behind. Moreover, despite a less threatened position at present, many of the modern refugees have a dread of the future in their homelands that has been fed by events of the past. As to placement opportunities, one need only attend a gathering of mathematicians from institutions training Ph.D.'s to hear how bitterly disappointing, even desperate, the search for jobs has become for all but the very top young people.

In the articles under discussion, we learn how foundations and private donors responded generously with funds to tide over the new arrivals until the approach of war increased opportunities. We may hope, not very optimistically in my view, that the much-forecast shortages will give more benign relief from the present difficulties. We see today some local instances of the kind of generosity of the earlier period, notably at Harvard, but a national strategy for seizing the opportunity for replenishment of American mathematics is no more in evidence now than then.

Essays dealing with single institutions, generally those that will be recognized as having been prominent over the years, make up about one-fourth of the whole work. Readers may find particularly informative the account by Roger Cooke and V. F. Rickey (in the third volume) of the noble experiment at Clark University, where a strictly graduate institute thrived for a little more than a decade (1889–1900) and continued to operate at high quality thereafter until inadequate funding and administrative decisions extinguished it about 1920. This essay and a number of others (even some by mathematicians, such as that by W. L. Duren, Jr., in the second volume on "Mathematics in American Society") offer enticing bibliographies.

The last-mentioned piece, covering the century of the AMS, offers explanations for what the author sees as the ups and downs of mathematics in the national

consciousness. He finds a villain in a "Professional Education Bureaucracy," so pervasive that he finds it convenient to refer to it by initials. He sees the adoption of the elective system as an abandonment of our discipline (along with classical languages), leading to a flight on a broader front from intellectually challenging subject matter at the secondary level. Here he assigns to PEB the leadership role for which the Duke of Plaza-Toro is famous. He dates the resulting malaise as lasting until about 1940, when only its wartime contributions raised mathematics in public esteem. He finds these and the tide of postwar expansion, with some help from Sputnik, to have kept us riding high until about 1970, when a decline abruptly set in, one that we have yet to see the end of. The author's reflections end with provocative observations on the present.

Duren does not ignore political entanglements involving mathematicians, and sociopolitical matters motivate perhaps a half-dozen other essays. Leaving these and many other articles aside, let us turn to what will be for most readers the meaty pieces, those that are quite strictly mathematical.

In the first volume, there are four such essays, a short one by Kleene on mathematical logic, a longer one by Whitney on topology, a piece by Knuth on algorithms, and an account by Gorenstein of the classification of the simple finite groups. The one by Kleene more or less ends in 1960, without many references, and concentrates on topics close to the author's research. Thus, some of the most exciting interactions of logic with mathematics developed in the last thirty years, such as the Davis/Putnam/(J.) Robinson/Matijasevič solution of Hilbert's tenth problem, Shelah's solution of the Whitehead problem, Solovay's work on automatic continuity, and all of nonstandard analysis are beyond its scope. Whitney's is more ambitious. Although his announced purpose is to leave us in the 1940's, he gives insights into thoughts of his own that have contributed significantly to the later development of topology. The short essay by Knuth presents observations on traditional mathematics that arose in the analysis of algorithms. Gorenstein traces progress on the classification problem through his own work and his contacts with other leading figures, up until about 1972 and the beginning of the final steps, mainly by Aschbacher.

The second volume has papers by Taussky on algebraic number theory, by Osserman on differential geometry, by Bott on the interplay of topology and analysis, and by Kleiman on the quite timely subject of intersection homology theory. Probably the last, more than forty pages long and rich in interactions with other current mathematics, will prove formidable to all but a few readers. This volume also contains the problems posed at the 1946 Princeton Bicentennial Conference, followed by comments by eight leading mathematicians on what has happened to the problems and related fields since that conference. With a few exceptions the problems have given rise to major achievements, or efforts on them have expanded into large chunks of exciting mathematics. References in most of the commentaries are only suggested (as "Gerosh showed in 1976 that . . ." [2, p. 341]). With this reservation, they serve as neat summaries of a great deal of modern mathematics.

The two substantial mathematical essays in the final volume are one by Masani on the work of Wiener and one by Wermer on function algebras. Masani claims to survey about "70 percent of Wiener's mathematical work and 25 percent of his work in the empirical realms" [3, p. 328]. The mathematics treated is remarkable in its range and imagination, particularly for the ideas that arose in his concern with problems of physics and of engineering. For one example of how far he was ahead of his time, we find on p. 312 a 1926 quote from Wiener, followed by a comment by L. Schwartz, showing that Wiener recognized the need in differential equations for the theory that ultimately became the theory of distributions. Wermer sketches a fascinating story of interplay between abstract functional analysis and classical function theory.

Finally, there is a treatment of the history of (the history of) mathematics in America—parentheses seem appropriate here, where the associative law may not apply—by Merzbach, one of the assistant editors. Along with sketches of the lives and works of the pioneers, she traces the subject through periods of growth and decay. Fortunately, she sees an upswing in command now, of which these volumes bear witness. She ends with a caution to workers in the history of mathematics "to beware of both its popularity and its methodological champions" [3, p. 664]. No doubt the readers of *Historia Mathematica* will recognize more immediately than does this mathematician the meaning of the second warning.

This review has touched on only a few of the essays. Even if nothing mentioned here is of special interest to its reader, there is plenty more. Take a volume off the shelf and browse. Try perhaps the piece by Andrews, or that by Donaldson, or Stigler's reprint, or one of the papers in the second volume on applied mathematics in America. There are starting points for new interests everywhere, usually with significant bibliographic help. The works promise to be the source of first resort for workers investigating developments in modern American mathematics.

The Development of Newtonian Calculus in Britain, 1700–1800. By Niccolò Guicciardini. Cambridge/New York (Cambridge University Press). 1989. xii + 228 pp. $54.50.

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The eighteenth century has generally been regarded as a period of isolation and decline for British mathematics, caused perhaps by a nationalistic loyalty to Newtonian notation and the geometric methods of the *Principia,* perhaps also by the simple absence of any mathematicians of Newtonian stature; and this period of stagnation is supposed to have been broken only by the reforms instituted by the Analytical Society, founded at Cambridge in 1812. Florian Cajori, the author